

-44-

What is claimed is:

1. A composite structural material comprised of a dimensionally stable core material ensheathed in a laminar covering that is bonded to the core material, wherein the laminar covering is comprised of at least one band of substantially parallel reinforcing cords bonded to at least one layer of a dimensionally stable web material selected from the group consisting of rigidified paper and rigidified cloth.
2. The composite structural material of claim 1, wherein the material is elongated, the at least one band of cords is oriented in the longitudinal direction of the structural material and extends substantially the entire length thereof, and at least some of the cords are bonded to the web material in a pretensioned state.
3. The composite structural material of claim 2, wherein the structural material has a substantially uniform cross-section throughout its length, and wherein the width of the band of cords occupies about 25 to 100 percent of the circumference of that cross-section.
4. The structural material of claim 3, wherein the cords are the warp of a strip of cloth that has been bonded to the web material under tension in the warp direction.
5. The composite structural material of claim 4, wherein the cloth is bonded to the web material by a thermosetting resin.
6. The composite structural material of claim 5, wherein the web material is paper that is impregnated with a rigidifying synthetic resin.
7. The composite structural material of claim 6, wherein the paper comprises cellulosic fibers.

-45-

8. The composite structural material of claim 7, wherein the laminar covering comprises at least one combination of a layer of said cloth bonded to said paper layer, in which the paper layer is exterior to the cloth layer.

9. The composite structural material of claim 8, wherein the outermost layer of the laminar covering is a two-ply paper in which a layer of resin that is a barrier to the bleeding through of an epoxy resin is sandwiched between the two plies, and wherein the innermost layer of the laminar covering is paper that is devoid of such a barrier layer.

10. The composite structural material of claim 9, wherein the resinous matrix comprises a thermosetting resin.

11. The composite structural material of claim 10, wherein the core material is comprised of pieces of a filler solid embedded in a resinous matrix.

12. The composite structural material of claim 10, wherein the core material has a crush resistance of at least about 300 pounds per square inch.

13. The composite structural material of claim 11, wherein the pieces of filler solid comprise pieces of one or more solids selected from the group consisting of lignocellulosic materials, cellulosic materials, vitreous materials, cementitious materials, carbonaceous materials, plastics, and rubbers.

14. The composite structural material of claim 11, wherein the pieces of filler solid comprise at least one member of the group consisting of rubber tire fragments, glass microspheres, expandable polymer beads, and expanded perlite.

-46-

15. The composite structural material of claim 14, wherein the resinous matrix comprises a resin selected from the group consisting of epoxy resins and polyurethane resins.

16. The composite structural material of claim 15, wherein the laminar covering comprises at least one combination of a said paper layer bonded to a said cloth layer in which the warp is composed at least primarily of synthetic fibers or filaments.

17. The composite structural material of claim 15, wherein the laminar covering comprises at least one combination of a said paper layer bonded to a said cloth layer in which the warp is composed at least primarily of polyester fibers or filaments.

18. The composite structural material of claim 15, wherein the laminar covering comprises at least one combination of a said paper layer bonded to a said cloth layer in which the warp of the cloth is composed at least primarily of polyester fibers or filaments and the paper is composed at least primarily of cellulosic fibers.

19. The composite structural material of claim 18, wherein the resinous matrix comprises a foamed polyurethane resin.

20. The composite structural material of claim 19, wherein, in the laminar covering, the innermost and outermost layers are layers of paper composed at least primarily of cellulosic fibers and the outer ply of the outermost layer is thinner than the inner ply of that layer.

-47-

21. The composite structural material of claim 20, wherein each paper layer is impregnated with a cured epoxy resin that helps bind the cloth and the core material to the paper.

22. The composite structural material of claim 21, wherein the laminar covering comprises at least one combination of a kraft paper layer bonded to a said cloth layer in which the cloth is composed at least primarily of continuous polyester filament, the warp cord is selected from the group consisting of monofilament cord having a diameter of about 0.010 to 0.015 inch and multifilament cord having a denier of about 600 to 1,000, and the cloth has a warp direction tensile strength in the range of about 90 to 200 pounds per lateral inch of the cloth.

23. The composite structural material of claim 22, wherein the kraft paper in at least one combination has a basis weight of about 65 to 100 lbs.

24. The composite structural material of claim 23, wherein the core material has a crush resistance of about 300 to 2,500 pounds per square inch.

25. The composite structural material of claim 24, wherein the laminar covering comprises at least one said cloth layer in which the strip of cloth is bonded to the paper layer under a tension, in the warp direction, of at least about 10 pounds per each inch of width of the cloth.

26. The composite structural material of claim 25, wherein its cross-sectional shape is rectangular, so that the structural material has four sides, and wherein the laminar covering comprises at least one said pretensioned cloth layer that covers at least one side of the structural material.

-48-

27. The composite structural material of claim 25, wherein its cross-sectional shape is a non-square rectangle, so that the structural material has two, opposite wide sides and two, opposite narrow sides, and wherein the laminar covering comprises at least one said pretensioned cloth layer covering each of said wide sides of the structural material.

28. The composite structural material of claim 27, wherein the laminar covering is comprised of two opposed, overlapping, conjoined, C channels, each C channel covering one of the wide sides and running the entire length of the structural material.

29. The composite structural material of claim 5, wherein the cloth is woven.

30. The composite structural material of claim 5, wherein the cloth is cross-laid scrim.

31. The composite structural material of claim 7, wherein the cloth is woven.

32. The composite structural material of claim 7, wherein the cloth is cross-laid scrim.

33. The composite structural material of claim 10, wherein the cloth is woven.

34. The composite structural material of claim 10, wherein the cloth is cross-laid scrim.

-49-

35. The composite structural material of claim 15, wherein the cloth is woven.

36. The composite structural material of claim 15, wherein the cloth is cross-laid scrim.

37. The composite structural material of claim 20, wherein the cloth is woven.

38. The composite structural material of claim 20, wherein the cloth is cross-laid scrim, in which the warp cords face outwardly.

39. The composite structural material of claim 26, wherein the cloth is cross-laid scrim in which the warp cords face outwardly.

40. The composite structural material of claim 10, wherein the material has an aspect in at least one cross-sectional direction that is at least 0.1.

41. A method of making an elongated, composite, structural material, comprising the following steps:

- a) obtaining a first elongated C channel of a porous web material related from the group consisting of paper and cloth that is impregnated with a thermosetting resin precursor mixture and orienting the channel with the C facing up;
- b) impregnating a strip of cloth with a thermosetting resin precursor mixture that is compatible with the resin precursor mixture in the web material;
- c) laying said strip of cloth on the inside bottom of the first C channel, with the warp running in the lengthwise direction of the channel, so as to extend the length of the channel;

-50-

d) depositing on the top of said strip of cloth a fluid matrix resin precursor composition that is compatible with both the resin precursor mixture in the web material and the resin precursor mixture in the cloth and which, when reacted, yields a matrix resin that is at least semi-rigid;

e) covering the first C channel with a second C channel of a porous web material that is impregnated with a thermosetting resin precursor mixture that is oriented with the C facing down, so that the vertical sides of the two channels overlap and touch each other and the two C channels define a core space between them; and

f) holding the two C channels together under conditions that are conducive to the setting of (i) the matrix resin in the core space, (ii) the thermosetting resin in the porous web material, and (iii) the thermosetting resin in the cloth, and for a length of time sufficient for all three resins to set, whereby the two C channels are bonded together where they overlap, the cloth strip is bonded to the first C channel, the core space is filled with the matrix resin, and the matrix resin is bonded to the cloth and the web material.

42. A method of making an elongated, composite, structural material, comprising the following steps:

a) forming a foldable laminate of two strips of porous web material selected from the group consisting of paper and cloth, with at least one strip of cloth sandwiched therebetween, with the warp of the cloth running in the lengthwise direction and with the strips of porous web material and all materials lying between those strips being impregnated with a thermosetting resin precursor mixture;

b) folding the laminate into a trough shape and orienting it horizontally, with one of the strips of porous web material on the top and the other strip of porous web material on the bottom;

c) depositing in the trough of the laminate, while still foldable, a fluid matrix resin precursor composition that is compatible with the resin precursor

-51-

mixture in the laminate and which, when fully reacted, yields a thermoset matrix resin that is at least semi-rigid;

d) folding closed and sealing shut the laminate so that it surrounds and defines a core space containing said matrix resin precursor composition; and

e) holding the closed laminate and its contents in a mold under conditions conducive to the setting of both the thermosetting resin in the laminate and the matrix resin in the core space, for a time sufficient for both resins to set, whereby (i) the laminate and the matrix resin are both made at least semi-rigid, (ii) the matrix resin, together with any filler solid it may contain, fills the core space, and (iii) the laminate and matrix resin are bonded together.

43. The method of claim 42, wherein the matrix resin precursor mixture comprises the reactants and blowing agent necessary to form a foamed polyurethane that is at least semi-rigid.

44. The method of claim 43, wherein the two strips of web material are paper.

45. The method of claim 44, wherein the bottom strip of paper is a two-ply paper in which a layer or resin that is a barrier to the bleeding through of an epoxy resin is sandwiched between the two plies, and wherein the top strip of paper is devoid of such a barrier layer.

46. The method of claim 45, wherein the thermosetting resin precursor mixture comprises the reactants necessary to form an epoxy resin.

47. The method of claim 46, wherein the cloth sandwiched between the strips of paper has a warp comprised either of continuous polyester filament or of fiberglass.



-52-

48. The method of claim 47, wherein, during step e, the laminate is held under sufficient tension in the lengthwise direction that the outer paper layer of the structural material resulting from that step is substantially unwrinkled.

49. The method of claim 48, wherein, during step e, the cloth sandwiched between the strips of paper has a warp comprised of continuous polyester filament, and said cloth is held under sufficient tension in the lengthwise direction that the warp cords are stretched to about 10 to 85% of their capacity.

50. The method of claim 48, wherein the matrix resin precursor composition comprises pieces of at least one filler solid selected from the group consisting of tire rubber, glass microspheres, expandable polymer beads, and expanded perlite.

51. The method of claim 48, wherein the matrix resin precursor composition contains pieces of tire rubber containing no more than about 3 percent of belt metal, based on the weight of the rubber, and the amount of such rubber is such that it constitutes about 20 to 90 volume percent of the finished material's core.

52. The method of claim 48, wherein the matrix resin precursor composition contains glass microspheres, the weight majority of which have a particle size in the range of about 5 to 225 microns, and the amount of such microspheres is such that they constitute about 2 to 90 volume percent of the finished material's core.

53. The method of claim 48, wherein the matrix resin precursor composition contains expanded perlite in an amount such that it constitutes about 10 to 80 volume percent of the finished material's core.

-53-

54. An elongated, four-sided, composite structural material having a substantially uniform, rectangular cross-section throughout its length, the material being comprised of a rigid polyurethane foam core material ensheathed in a laminar covering that is bonded to the core material by a thermosetting resin, wherein the laminar covering is comprised of at least one band of cloth, bonded to a layer of paper that is impregnated with a sufficient amount of a rigidifying thermosetting resin to render the paper dimensionally stable, with the warp of the cloth being oriented in the longitudinal direction of the structural material and extending substantially the entire length thereof, and with said at least one band of cloth substantially covering at least two opposite sides of the structural material, and wherein the core material has a crush resistance of at least about 300 psi.

55. The structural material of claim 54, wherein the core material comprises pieces of at least one filler solid selected from the group consisting of tire rubber, expanded perlite, expandable polymer beads, and glass microspheres and has a crush resistance in the range of about 300 to 1700 psi.

56. The structural material of claim 54, wherein the core material has a crush resistance in the range of about 1800 to 2500 psi.

57. A shipping pallet comprised of deck boards and deck-support boards selected from the group consisting of (a) stringers and (b) a combination of blocks and connector boards wherein at least one of the deck boards or deck-support boards is an elongated, four-sided, composite structural material having a substantially uniform, rectangular cross-section throughout its length, the material being comprised of an at least semi-rigid polyurethane foam core material ensheathed in a laminar covering that is bonded to the core material by a thermosetting resin, wherein the laminar covering is comprised of at least one band of cloth, bonded to a layer of paper that is impregnated with a sufficient amount of a rigidifying thermosetting resin to render the paper dimensionally stable, with the

-54-

warp of the cloth being oriented in the longitudinal direction of the structural material and extending substantially the entire length thereof, and with said at least one band of cloth substantially covering at least two opposite sides of the structural material, and wherein the core material has a crush resistance of at least about 300 psi.

58. The shipping pallet of claim 57, wherein the core material in each of the composite deck boards comprises pieces of at least one filler solid selected from the group consisting of tire rubber, expanded perlite, expandable polymer beads, and glass microspheres, and has a crush resistance in the range of about 300 to 1700 psi.

59. The shipping pallet of claim 58, wherein the core material in each of the composite deck-support boards comprises pieces of at least one filler selected from the group consisting of tire rubber and glass microspheres and has a crush resistance in the range of about 1800 to 2500 psi.

60. The shipping pallet of claim 58, wherein each band of cloth in each of the composite deck boards and deck-support boards has at least about 12 warp cords per lateral inch of cloth.

61. The shipping pallet of claim 60, wherein each of the four sides of each composite board is substantially completely covered by said at least one band of cloth.

62. The shipping pallet of claim 59, wherein each band of cloth in each of the composite deck boards and deck-support boards has at least 12 warp cords per lateral inch of cloth.

63. The shipping pallet of claim 62, wherein each of the four sides of each

-55-

composite board is substantially completely covered by said at least one band of cloth.

64. The shipping pallet of claim 63, wherein it is a stringer pallet and each of the deck boards is a said composite deck board and each of the stringers is a said composite stringer.

65. The shipping pallet of claim 64, wherein the core material in each composite deck board comprises about 40 to 50 volume percent of expanded perlite.

66. The shipping pallet of claim 57, wherein there is present in the laminar covering of at least one of the said composite boards or blocks an embedment of a material that is dissimilar from the core and covering and which has a physical property that can be measured from a distance and can serve as an identifying feature of the pallet.

67. The shipping pallet of claim 66, wherein the embedded material is a metallic layer on a substrate.